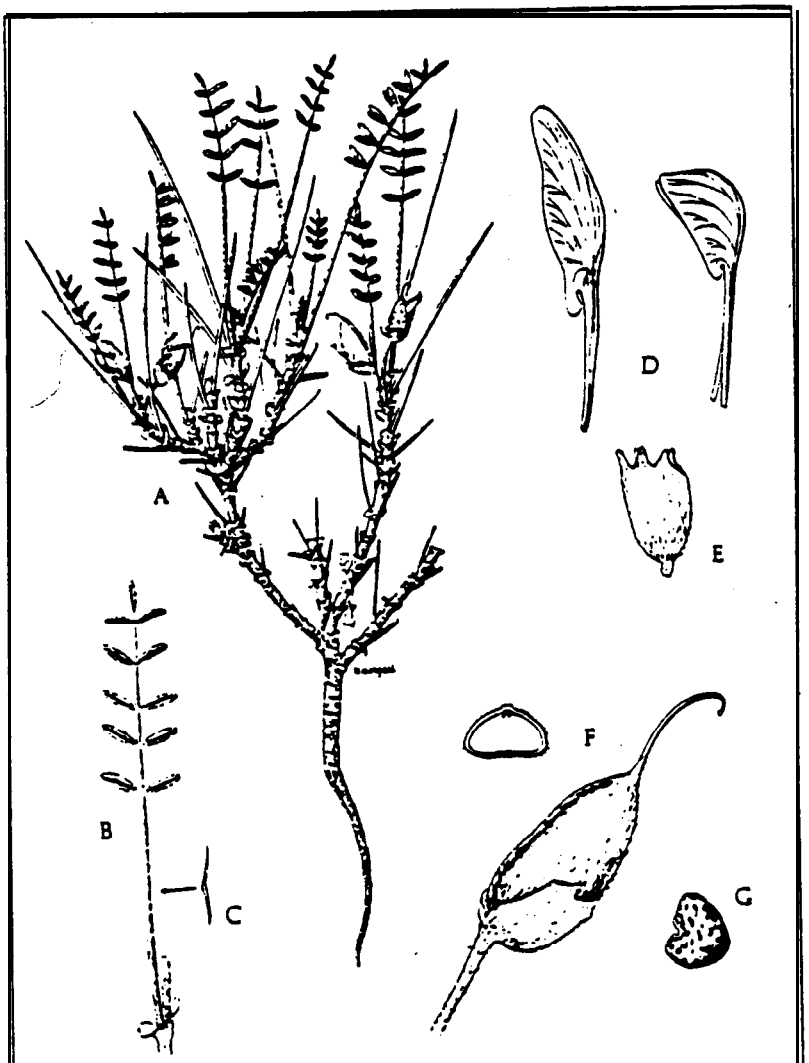
MANCOS MILKVETCH

(*Astragalus humillimus*)

RECOVERY PLAN

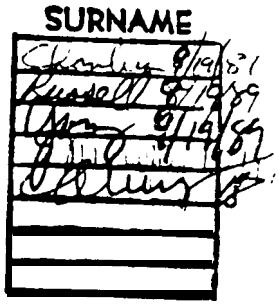


Astragalus humillimus
A. general habit; B. leaf; C. dolabriform hairs on stem; D. wing and keel petals; E. calyx; F. pod; G. seed

U.S. Fish and Wildlife Service

1989

Albuquerque, New Mexico



KANCOS MILKVETCH

(*Astragalus humillimus*)

RECOVERY PLAN

Prepared by:

Paul J. Knight

New Mexico Department of Natural Resources

Santa Fe, New Mexico

and

Donna House

Navajo Heritage Program

Window Rock, Arizona

for

U.S. Fish and Wildlife Service, Region 2

Albuquerque, New Mexico

Edited by:

Peggy Olwell

APPROVED: _____

DATE: 12/20/89

DISCLAIMER

This is the completed Hancos Milkvetch Recovery Plan. It has been approved by the U.S. Fish and Wildlife Service. It does not necessarily represent official positions or approvals of cooperating agencies and does not necessarily represent the views of all individuals who played a role in preparing this plan. This plan is subject to modification as dictated by new findings, changes in species status, and completion of tasks described in the plan. Goals and objectives will be attained and funds expended contingent upon appropriations, priorities, and other constraints.

Literature Citations should read as follows:

U.S. Fish and Wildlife Service. 1989. Hancos milkvetch (*Astragalus humillimus*) Recovery Plan. U.S. Fish and Wildlife Service, Albuquerque, New Mexico. 47 pp.

Additional copies may be purchased from:

Fish and Wildlife Reference Service
6011 Executive Blvd.
Rockville, Maryland 20852
(301) 770-3000

l-800-582-3421

ACKNOWLEDGEMENTS

Information and assistance in preparation of this plan were provided by Steve O'Kane and Tamara Nauman of the Colorado Natural Areas Program and Mark Porter of Farmington, New Mexico.

SUMMARY

GOAL: To remove Mancos milkvetch from the Federal list of endangered and threatened species by managing the essential habitat to sustain natural populations in the wild.

RECOVERY CRITERIA: The criteria for downlisting the Mancos milkvetch to threatened will be to census and map all known populations and from this data develop formal documentation of long term. mineral, oil, gas, and energy development potential in the area: develop a habitat management plan to administer mineral development in the area and to provide for this species' welfare; and establish long term monitoring plots at population sites from which biological data on the species can be gathered. The criteria for delisting will be to demonstrate that long-term stability in population levels has been reached with continued assurance that threats have been alleviated for all presently known populations and 75 percent of any newly discovered populations.

ACTIONS NEEDED: The major steps needed to meet the recovery criteria include: remove threats by coordinating with the Bureau of Indian Affairs (BIA), Navajo Nation, the Ute Mountain Ute Indian Tribe, the Bureau of Land Management (BLM), the New Mexico Department of Energy, Hinerals, and Natural Resources, and oil and gas development companies in the area: enforce existing laws and regulations; assemble documentation on mineral, oil, gas, and energy potential or planned development, and develop a habitat management plan in cooperation with the involved agencies for the long term protection of population sites: install permanent monitoring plots at population sites and initiate biological, ecological, and geological studies of the species and its habitat to develop an understanding of the requirements needed to sustain healthy populations: and develop a public awareness of the uniqueness of the Mancos milkvetch.

TABLE OF CONTENTS

PART I

INTRODUCTION

Brief Overview

The Mancos milkvetch (*Astragalus humillimus* Gray ex. Brandegee) was listed as an endangered species on June 27, 1985 (USFWS 1985a) by the U.S. Fish and Wildlife Service. The species is known from northwestern New Mexico and southwestern Colorado (Four Corners area), occurring in scattered populations between the town of Towaoc, Colorado, and the Chaco River of New Mexico. This species remained virtually unknown after its discovery in 1875 until a chance collection near Waterflow, New Mexico, in 1980. This collection provided the first data on its habitat requirements. Intensive field surveys conducted by a variety of organizations and independent botanists have significantly increased the number of known population sites. To date, all but one site occur at least primarily on lands of the Navajo Nation and the Ute Mountain Ute Tribe. The remaining site and portions of other sites occur on New Mexico State Trust land or land administered by the Bureau of Land Management (BLM). The Hancos milkvetch is threatened by modification of its habitat due to oil, gas, mineral, and energy development, due to general mineral exploration in the San Juan Basin, and by loss of plants due to collecting.

The Mancos milkvetch is a member of the genus Astraaalus that is known to contain many rare and often highly endemic species. At present, 80 members of the genus are listed in the 1985 notice of review (USFWS 1985b) as candidates for listing. In addition to Hancos milkvetch, four other

species in the genus, Astraoalus montii, A. osterhoutii, A. phoenix, and A. tobbinsii var. jesupi are listed as threatened or endangered under the Endangered Species Act.

This plan outlines the-steps necessary to achieve and document long-term stability of Bancos milkvetch populations in the wild by removing and preventing threats to this species and its habitat. Attainment of these goals will lead to the ultimate'objective of removal of the Mancos milkvetch from the Federal list of endangered and threatened species.

Taxonomy

Astraaalus humillimus was first collected by T.S. Brandegee (1876) in July 1875, "near the mouth of Mancos Canyon on the Mesa Verde" in southwest Colorado (holotype at New York Botanical Gardens). Barneby (1964) states that Brandegee left unusually precise records of the habitat of the Mancos milkvetch, but despite this, the type locality was not relocated until 1987 by Colorado Department of Natural Resources (1987). The taxon remained a mystery for 105 years until it was rediscovered near Fruitland, New Mexico, in the summer of 1980. In the successive years from 1980 through 1988, nine more population sites were discovered in New Mexico and three sites were discovered in Colorado.

Astraqalus humillimus was first described by Gray in 1876 in the Bulletin of the U.S. Geological Survey. The name was changed to Traqacantha humillima by Kuntze(1891), changed again to Phaca humillima by Rydberg (1905), and was finally placed in the genus Astraaalus, Section

Humillimi, by Barneby (1964). The Hancos milkvetch is most closely related to A. siliceus and A. wittmanii, and is easily distinguished from these species by its persistent subspinescent petioles.

Morphology

The Mancos milkvetch is a diminutive, tufted perennial forming clumps up to 30 cm (12 inches) across, that are crowned with a dense aggregation of persistent, spiny leaf stalks. The stems are up to 1 cm (0.4 inch) long, and are crowded with leaves along their entire length. The leaves are up to 4 cm (1.6 inch) long, each with 7-11 oval leaflets, 0.7-2.0 mm (0.1 inch) in length. Flowers are lavender to purplish with a conspicuous lighter-colored spot in the throat of the corolla tube. The banner is usually 7-10 mm (0.25-0.4 inch) long, with the keel and banner petal between 6-8 mm (0.25 inch) in length. Fruits are egg shaped, are about 4.5 mm (0.2 inch) long and 2 mm (0.1 inch) wide, and each produces 4-9 seeds.

Past and Present Distribution and Abundance

Mancos milkvetch is known only from remote semi-arid sandstone rimrock ledges and mesa tops of northwest New Mexico and southwest Colorado (Figure 1). The species' specificity to highly localized sandstone outcrops in the Four Corners area suggests that its present and historic range are probably similar. The remoteness of the region is typified by the fact that 105 years passed between its original collection and its rediscovery in 1980.

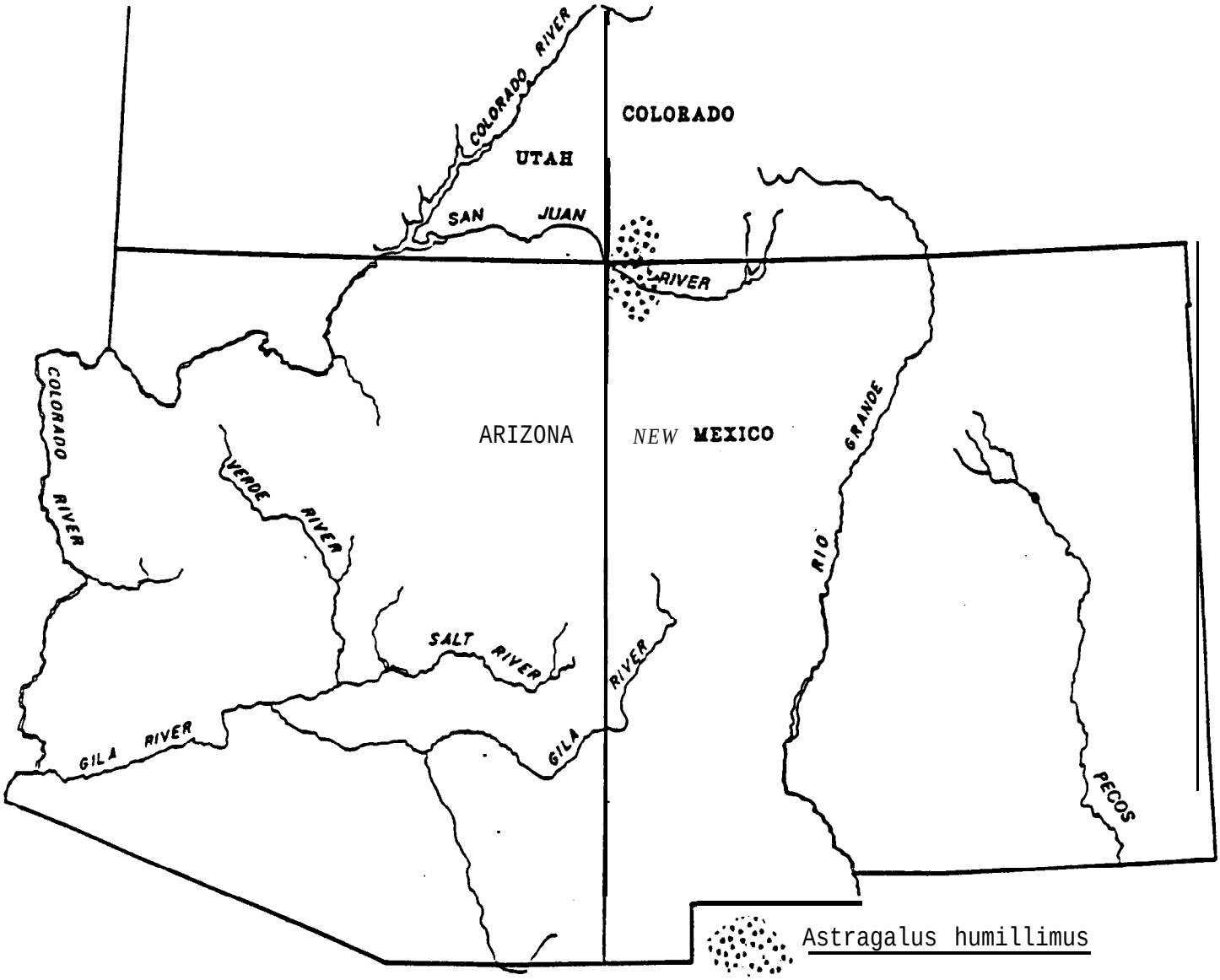


Figure 1. Distribution of Astragalus humillimus in Colorado and New Mexico.

The known geographic distribution of Mancos milkvetch extends from Mancos Canyon, Colorado, in the north, continuing southward for about 25 miles to just south of the San Juan River in San Juan County, New Mexico. The distribution closely follows a narrow band of Mesozoic sandstone.

Thirteen sites are presently known: ten in San Juan County, New Mexico, and three in Montezuma County, Colorado. The majority (12) of the extant population sites are primarily on lands of the Navajo Nation and Ute Mountain Ute Tribe, with small inholdings at one site by the BLM (Table 1). Another site is primarily on New Mexico Trust Lands, with a small inholding by the Navajo Nation. The total area of all 13 known sites is approximately 140 acres. Field counts of 4 of the 13 populations recorded 10,407 plants in 44.5 acres of habitat with an average density of 233 plants per acre.

Habitat

Hancos milkvetch is restricted to small, poorly defined tan colored units of the Point Lookout sandstone. This Cretaceous sandstone member -is part of the larger Mesa Verde stratigraphic series and represents the edge of a retreating Mesozoic seacoast. The substrate exfoliates into thin layers, which suggests an alternating deposition of parent material, possibly the result of an estuarine *or* riverine environment. The high degree of specificity of the Hancos milkvetch to this substrate suggests the presence of some element in the rock that the plant requires for normal

Table 1. Occurrence, size, and ownership of population sites.

Site Name	Area	No. of Individuals	Land Status
New Mexico Locations			
Porter Site	4.45 acres	1500’	Navajo Nation
Sleeping Rocks	12.29 acres	552	NM Trust Land
Slickrock House	18.11 acres	4200’	Navajo Nation
Slickrock Flats A	18.69 acres	7699	Navajo Nation, BLM
Slickrock Flats B	6.87 acres	1600’	Navajo Nation
Hogback South	8.60 acres	1935	Navajo Nation
North Long Point	10’ acres	500’	Navajo Nation
West Rim Site	5’ acres	500’	Navajo Nation
Mid Long Point	2’ acres	. 200’	Navajo Nation
South Long Point	20’ acres	8000’	Navajo Nation
Colorado Locations			
Chimney Rock Mesa North	4.95 acres	220	Ute Mountain Utes
Chimney Rock Mesa South	64 acres	2150’	Ute Mountain Utes
Tanner Mesa	2 acres	50’	Ute Mountain Utes

. Estimate

growth. The method of deposition of the unit could relate to the presence of a growth related element (e.g.., selenium, rubidium, etc.). Mancos milkvetch is usually found on large, nearly flat sheets of sandstone, and is clustered along the margins of bowl-like depressions that dot the bedrock. Its roots spread out into the basin of the depression and proliferate about 7 cm (2-3 inches) below the surface. Mancos milkvetch also can be found in cracks or fissures in the sandstone or at the base of gentle slickrock inclines. The substrate is characterized by exfoliation and this physical property may be an important factor influencing the distribution of the taxon.

The mean elevation for known populations is approximately 1,854 meters (5,650 feet), with a gradual but steady increase in elevation of 0.005 percent slope from the southernmost location at 1,731 meters (5,275 feet) to the northernmost known site at 1,969 meters (6,000 feet). This gradual incline to the north probably reflects an overall tilting of the geologic formation in the region, and may be useful in predicting and defining potential habitat. The Mancos milkvetch occurs in an area that receives between 20-23 cm (8-9 inches) of rainfall a year, with approximately 150 days without a killing frost. The last killing frost in the spring occurs on about April 25, and the first killing frost in the fall occurs on about October 8 (Tuan et al. 1973).

Associated Species

The associated plant community is generally confined to small pockets or depressions on gentle slopes in the sandstone. Trees are small, shrubby,

and very sparse. Vegetative cover is high in the shallow soil pockets, but overall cover is low, probably less than 5 percent. In addition to A. humillimus, several other unusual and peripheral species occur at the sites (Martin and Hutchins 1980). These species are Fraxinus anomala, Brickellia microphylla var. scabra, Cercocarpus intricatus, and Gilia roseata (Deardorff 1982). The occurrence of these peripheral species, together with Astragalus humillimus on this peculiar edaphic substrate of exfoliating sandstone, suggests that these species may be avoiding competition from the dominant vegetation through a tolerance of, rather than a requirement for, peculiar soil properties (Major and Bamberg 1963). A partial list of species in association with Astragalus humillimus follows:

TREES

Fraxinus anomala (single leaf ash)

Juniperus osteosperma (Utah juniper)

Pinus edulis (pinyon pine)

SHRUBS

Artemisia tridentata (big sagebrush)

Atriplex canescens (four wing saltbush)

Cercocarpus montanus (mountain mahogany)

Cercocarpus intricatus (small-leaf mahogany)

Ephedra viridis (Morman tea)

Peraphyllum ramosissimum (squaw apple)

Purshia tridentata (antelope brush)

SHRUBS (continued)

Rhus trilohata (skunkbush)

Yucca ansustissima (narrow-leaf yucca)

SUBSHRUBS AND HERBACEOUS PLANTS

Astraaalus calycosus var. scaposus (Torrey milkvetch)

Astraaalus lentiuinosus var. diphysus (milkvetch)

Astraaalus monumentalis var. cottamii (Cottam's milkvetch)

Brickellia microphylla var. scabra (scabrous bricklebush)

Calylophus hartweaii (yellow falseprimrose)

Chrysopsis villosa (yellow hiddenflower)

Cryptantha pterocarya (wing-fruited hiddenflower)

Galium coloradense (Colorado bedstraw)

Heterotheca villosa (telegraph plant)

Hymenoxys acaulis (bitterweed)

Lepidium montanum (peppergrass)

Lesquerella fendleri (Fendler's bladderpod)

Petradoria pumila (goldenrod)

Penstemon eatonii (Eaton's beardstongue)

Penstemon lentus (beardtongue)

Physaria acutifolia (twinpod)

Senecio multilobatus (many lobed senecio)

Stanleya pinnata (desert plume)

GRASSES

Bromus tectorum (downy grass)

Oryzopsis hymenoides (Indian rice)

Poa fendleriana (mutton grass)

Stipa comata (needle and thread grass)

Pooulation Biology

Astragalus humillimus is known from 13 localities with a total area of approximately 140 acres. The density within each of these populations can vary dramatically. The Sleeping Rocks site covers 12.3 acres with a total population of 552 plants, averaging 44.9 plants per acre. The Slickrock Flats site covers 18.8 acres with a total of 7,699 plants and an average density of 411 plants per acre. These figures reveal the disparity of a nearly 1,000 percent difference in density in these population sites. This sizable difference is probably a result of the difference in topography of the two sites and the habitat preference of the Mancos milkvetch. The Slickrock Flats site is a large, gently inclining sheet of slickrock sandstone, generously potted with sizable depressions. The Sleeping Rocks site is situated on a cluster of small sandstone islands that are highly dissected and broken by numerous shelves and terraces with few depressions or soil pockets. The disparity suggests that maximum population development and density is best achieved on large nearly flat surfaces with pockets of shallow soil where rainfall accumulates. Within the depressions, population density can rise to 1 plant per square meter (10.8 square feet).

The Mancos milkvetch flowers in late April through early *May.* In a normal year, the peak of flowering *occurs* between April 26 and May 10. The flowers are visited by honeybees and butterflies, and probably are subject to visits by other potential pollinators. *Larger* plants may produce over 100 flowers in a growing season, with the fruits setting rapidly and maturing by mid-June. The ovule number varies from four to nine in each fruit. Nothing is known about germination requirements: however, numerous juveniles occur at most of the sites. Susceptibility to disturbance is high, and if the surface conditions of the site are significantly altered, revegetation will not occur. Two of the locations have been disturbed by mineral exploration and energy development. One site was scraped by a bulldozer, effectively removing the pocketed depressions in the bedrock. This disturbance occurred nearly 25 years ago, and although A. humillimus individuals occur along the boundaries of .the disturbed area, there is no indication of reestablishment on the scraped surface. The second site was used as a quarry from which large amounts of rock were removed. However, this activity produced significant amounts of loose soil that accumulated in the quarried site, creating shallow fans of soil similar to those that accumulate in the depressions in the sandstone of undisturbed sites. These soil fans provided habitat for the reestablishment of young plants, and nearly 100 juvenile plants had colonized this location. Whether these plants will mature to reproductive adults is uncertain at this time, but their presence is significant and suggests a possible future method of reclamation of disturbed habitat site. However, this reclamation method needs to be investigated further.

Impacts and Threats

The major threat to Astraaalus humillimus is the surface disturbance activity associated with mineral, oil, gas and energy development. This activity occurs extensively in northwest New Mexico and southwest Colorado. Two of the 13 known sites have already been significantly impacted by such action. First, the Hogback south location was quarried for rock, resulting in the destruction of the northern portion of the Mancos milkvetch. Subsequently, the Sleeping Rocks site was transected by a powerline, and the construction of a tower destroyed segments of the southern portion of the population. Presently, the largest and best population at Slickrock Flats is completely surrounded by oil wells, with some of these wells occurring within 366 meters (400 yards) of the site boundary. If a well field were to be developed at Slickrock Flats, it would decimate a major portion of the A. humillimus population present. To assess this threat, a formal documentation of the long-term mineral, oil, gas and energy development plan of the Mancos milkvetch habitat needs to be assembled. After the plans are documented, a plan to alleviate these threats needs to be developed.

The rarity and unusual nature of this plant has prompted taking of specimens by botanists who desire this taxon for their herbarium collections. Even though a relatively small number of plants are collected per year, taking must be considered a threat because over a long period of time it can have a significant impact on some of the smaller populations.

Habitat disturbance by off-road vehicles (ORVs) is not presently a threat to the Mancos milkvetch, and the topography of most of the sites precludes access to other types of motor vehicles. However, some of the sites are adjacent to existing dirt roads, and at these locations ORV activity could pose a potential threat.

Livestock grazing has long occurred on and around many of the population sites, but it has caused no documented effect on the populations. Sheep do not appear to eat the plant, and the low, spreading growth form of the plant seems to reduce the effect of trampling.

Presently, there are no data to suggest that acidic wet or dry deposition pose any threat to the Mancos milkvetch, though no data have been collected. However, northwestern New Mexico is a center for power production in the region. Two power plants are already on line, and another is scheduled for construction. Particulate and chemical fallout from power plants is often acidic, and thus acidic deposition is a potential threat to the species.

Natural processes such as erosion must-certainly account for some mortality. However, these processes are also responsible for the soil deposition in the bedrock depressions that are essential for the survival of this species. Damage to plants due to rodents or insects has not been documented.

Astraaalus humillimus is restricted to small, widely dispersed segments of sandstone, which results in small, scattered, and disjunct populations. This type of distribution impedes the flow of genetic material between the component populations, with the resulting constraints on the gene pool intensifying the external threats on the species.

Legal Protection

Astraaalus humillimus is on the New Mexico State Endangered Plant Species list, Section 1; a new Section of the State code (9-10-10 NMSA 1978). This Act protects listed plant species by prohibiting taking, possession, transportation, and exportation from the State; and processing, selling or offering for sale, and shipment of listed plants or plant materials within the State. However, listed species can be collected after obtaining a permit for scientific study or educational purposes. Plants cannot be collected from known population sites without prior approval of a research design from the New Mexico Department of Energy, Minerals and Natural Resources.

A permit is required to collect plants from the Navajo Indian Reservation. Currently, the Navajo Parks and Navajo Fish and Wildlife (NFW) Department have been handling plant permits by requiring NFW animal permits for plant collection on the Navajo Nation.

The Ute Mountain Ute Tribe requires a botanical collection permit for the removal of plant specimens from the reservation.

The Endangered Species Act of 1973, as amended in 1988, prohibits for areas under Federal jurisdiction the malicious damage, destruction, or removal and reduction to possession of plants listed under the Act. For all other areas, the Act prohibits removing, cutting, digging up, damaging, or destroying any listed plants in knowing violation of any State law or regulation, or in the course of any violation of a State criminal trespass law. The Act also prohibits any person subject to the jurisdiction of the United States from selling, offering for sale, importing, exporting, or transporting in interstate or foreign commerce in the course of a commercial activity, any listed plant species. Under certain circumstances, the Act also provides for the issuance of permits to carry out otherwise prohibited activities involving listed species. The Endangered Species Act provides additional protection for Astraaalus humillimus through Section 7 (inter-agency cooperation) requirements.

The Lacey Act, as amended in 1981, also provides protection for the Mancos milkvetch. This Act prohibits the import, export, sale, acquisition, purchase or interstate commerce or foreign commerce of any plant taken, possessed, or sold in violation of any law, treaty, or regulation of the United States, any Indian tribal law, or any regulation of any State.

PART II

RECOVERY

Objective

The main objective of this recovery plan is to protect Astraualus humillimus and manage its essential habitat so that healthy populations can be sustained in their natural habitats. To meet these objectives and to downlist the Hancos milkvetch to threatened, the following actions are required:

1. Develop formal documentation of the long-term mineral, oil, gas and energy development potential of the Mancos milkvetch habitat.

2. Develop habitat management plans to alleviate threats to the species and ensure permanent protection of 75 percent of the known habitat according to steps outlined in this plan.

3. Census and monitor known populations and establish permanent study plots at these sites.

Actions identified as necessary for meeting the main objective and for removing Astraaalus humillimus from the list of threatened or endangered species include:

1. Demonstrating long-term stability of populations and habitat through at least 10 years of monitoring.

2. Implementating actions that will provide permanent protection for all of the presently known plants and habitat', and 75 percent of any plants and habitat discovered in the future. These actions include: 1) contacting individual landowners or grazing leaseholders and reaching agreements on protecting plants; and 2) implementing management plans that provide guidelines for energy or minerals exploration and development, management of oil spills, chemical spills, or oil and gas well by-products, management of ORV use, and management of pipeline, powerline, and road rights-of-way.

Astragalus humillimus exists in relatively small numbers in a specialized limited habitat. For these reasons it is unlikely even the best management will produce any significant increases in the species. Delisting this species will therefore depend on establishing permanent management policies and procedures essentially equivalent to present protection under the Endangered Species Act.

The downlisting and delisting criteria for Astraoalus humillimus will be evaluated for adequacy upon attainment and prior to any proposed change in the species' endangered or threatened status.

Step-Down Outline

1. Protect existing populations of Astraqalus humillimus by removing threats to the species and by managing its habitat.

11. Enforce existing laws and regulations and consider development of new regulations.

12. Document and assess the mineral, oil, gas, energy, and any other development potential on or near population sites.

    121. Prepare an assessment of the mineral, oil, gas, and energy development potential.

    122. Document the existing oil, gas, and mineral leases on or near population sites.

    123. Make an assessment of any other potential development in the area.

13. Contact individual landowners on the Navajo Nation and the Ute Mountain Ute Indian Reservation.

14. Develop memoranda of understanding or cooperative agreements between the BIA, Navajo Nation, Ute Mountain Utes, BLM, the State of New Mexico, and the U.S. Fish and Wildlife Service on the management of Astrasalus humillimus.

15. Develop and implement habitat management plans to protect Astragalus humillimus and its habitat on Navajo land and on Ute Mountain Ute lands.

    151. Develop management guidelines for oil development.

        1511. Develop guidelines for the placement of well sites near population locations.

        1512. Develop guidelines for management in the event of oil or chemical spills near population sites.

    152. Develop management guidelines for ORV use near populations.

    153. Develop management guidelines for the development of right-

of-way routes near population ***sites.***

16. Develop and implement a habitat management plan to protect Astraaalus humillimus populations and their habitat on New Mexico State Trust lands.

17. Monitor populations and habitat.

171. Establish monitoring plots to collect biological and demographic data.

172. Establish monitoring plots to determine the effects of acidic dry and wet deposition on the Uancos milkvetch.

173. Monitor for other human and natural impacts on the populations.

2. Study populations in their natural habitat.

2 1 . Study the ecological requirements of the Mancos milkvetch.

211. Study the soil requirements and assess the effect of acid dry and wet deposition on the soil.

212. Study the water needs of the Uancos milkvetch.

213. Study the role of biotic factors in the Mancos milkvetch's ecology.

2131. Herbivores.

2132. Pollinators.

2133. Other organisms.

2134. Competition from dominant species.

214. Study the geology of the preferred habitat of the Hancos milkvetch.

22. Study the population biology of the Mancos milkvetch.

221. Life history requirements.

222. Demographic variation.

23. Develop reclamation techniques for disturbed population sites of Mancos milkvetch.

231. Gather data on soil erosion and aggradation on various slopes of the site.

232. Experiment with reclamation techniques on disturbed population sites.

24. Inventory other suitable habitat for Astraaalus humillimus.

25. Apply the results of studies undertaken in tasks 21, 22, 23, and 24 to revise the habitat management plan.

3. Conduct laboratory studies on the Hancos milkvetch.

31. Seed biology.

32. Chemical analysis of tissue.

4. Develop public awareness, appreciation, and support for preservation of Mancos milkvetch.

Narrative

1. Protect existinq populations of Astraqalus humillimus by removing threats to the species and by managina its habitat.

The Mancos milkvetch should be protected by controlling the impact of development on existing population sites, enforcing existing laws, and through careful monitoring of populations to detect change in demography or biology.

11. Enforce existing laws and reuulations and consider development of new reuulations.

All existing laws need to be enforced. These laws include the Endangered Species Act, the New Mexico Rare Plant Act, the Navajo Tribal Code, and the Lacey Act. Work with the Navajo Nation Council and the Ute Mountain Ute Council to place this taxon into their Tribal Codes as a Species of Special Concern.

12. Document and assess the mineral, oil, gas, eneruy, and any other development potential on or near population sites.

An in-depth field evaluation and planning study of all development potential should be undertaken for all areas on or adjacent to Mancos milkvetch locations.

121. Prepare an assessment of the mineral, oil, uas, and energy development potential.

Prepare a detailed report on the potential for oil, gas, coal, or mineral development or exploration on or around Mancos milkvetch populations.

122. Document the existing oil, gas, and mineral leases on or near population sites.

Study all lease records and document the existing oil, gas, coal, or mineral leases on and adjacent to Mancos milkvetch. sites.

123. Make an assessment of any other potential development in the area.

Assess and document the potential for other forms of development near Mancos milkvetch populations. These developments include rights-of-way, powerline or gasline routes, and access roads, as well as housing, corral sites, and recreational development.

13. Contact individual landowners on the Navajo Nation and Ute Mountain Ute Indian Reservation.

Some of the sites of Astragalus humillimus are on lands owned by individual tribal members. These members need to be identified and then notified of the presence of an endangered plant on their property. To ensure the recovery of the species, the landowners need to be informed of how they can protect the populations and the habitat on their property. In addition, the Service needs the landowners' permission for access onto their property to study the populations. Because most of the landowners do not know the plant occurs on their land and certain land management practices are detrimental to the species, this is a.priority one task necessary to prevent the irreversible decline of the species.

14. Develop memoranda of understandinu or cooperative aureements between the BIA, Navajo Nation, Ute Mountain Utes, BLM, the State of New Mexico, and the U.S. Fish and Wildlife Service on the manauement of Astraualus humillimus.

To facilitate the management and protection of this plant, memoranda of understanding or cooperative agreements between the BLM, the State of New Mexico, Indian Tribes, and the Fish and Wildlife Service should be developed. Such agreements should set forth the long-term objectives and general management activities that are needed.

15. Develop and implement habitat manaaement plans to Protect Astragalus humillimus and its habitat on Navaio land and on Ute Mountain Ute lands.

The habitat management plans should include guidelines for the protection of the Mancos milkvetch. To prevent the destruction of Mancos milkvetch habitat, the guidelines should consider biologically sound management policies to remove threats to each population. This is a priority one task because habitat destruction is a major threat to the species.

151. Develop manauement auidelines for oil development.

The management plan should include guidelines for regulating the oil development near Xancos milkvetch sites.

1511. Develop uuidelines for the placement of well sites near population locations.

One factor that may be contributing to the rarity of Astraaalus humillimus is its natural fragmentation into small-sized populations, resulting in lowered

genetic variability. Therefore, all Mancos milkvetch sites should be excluded from any new oil or gas wells and coal or mineral mines to prevent habitat destruction and further fragmentation of the population.

1512. Develop guidelines for manauement in the event of oil or chemical spills near population sites.
Wells uphill from or equal in elevation to adjacent Mancos milkvetch populations should have a plan developed to control and contain oil or chemical spills to avoid contamination of the site.

152. Develop manaoement quidelines for ORV use near populations.
Presently, no populations are being impacted by ORV use, but several populations are near dirt roads where -impacts are possible. Populations that could be impacted by ORV's should be monitored regularly. If any damage is detected, brush or stone should be used to block access and discourage further ORV travel.

153. Develop manaqement guidelines for the development of right-of-way routes near population sites.
Potential routes should be surveyed to determine the presence or absence of Astragalus humillimus plants.

16. Develop and implement a habitat management plan to protect Astraqalus humillimus populations and its habitat on New Mexico State Trust lands.

The central theme of this program will be the development of an agreement with the New Mexico State Land Office to protect the Sleeping Rocks site by minimizing future mineral, oil, and gas development at this location.

17. Monitor populations and habitat.

Monitoring is necessary to ensure maintenance of existing Mancos milkvetch populations and to avert threats to them. Long-term monitoring plots, read annually, should be established at all populations.

171. Establish monitorinu plots to collect biological and demographic data.

Permanent plots to monitor changes in vigor, density, frequency, and fecundity should be established at each Mancos milkvetch location. Monitoring. will provide data on changes in the population. Understanding these changes is necessary for the proper management of the species.

172. Establish monitorinq plots to determine the effects of acidic drv and wet deposition on the Mancos milkvetch.

Northwestern New Mexico is the chief power production location in the State. Presently, two large power plants

are operating, and another power plant is planned. These power plants emit gasses and particulates that may mix with precipitation or may be deposited dry on the Mancos milkvetch. The effects of acidic wet and dry deposition should be monitored at Mancos milkvetch locations.

173. Monitor for other human and natural impacts on the populations.

An annual inspection of each Mancos milkvetch site and adjacent land should detect any developing threats to the habitat.

2. Study populations in their natural habitat.

Because of the rarity of Mancos milkvetch, existing populations must be sustained in a healthy and vigorous state. To achieve this state, studies of the biology and ecology of the species and of its geologic and habitat preferences need to be performed. These studies will . provide information that will more clearly define occupied habitat, and lead to a better understanding of its potential habitat.

21. Study the ecological reuuirements of the Mancos milkvetch.

Implement studies to define and understand the habitat requirements of Mancos milkvetch. These studies include examination of soil, water, geologic, climatic, and interactive factors influencing the species.

211. Study the soil requirements and assess the effect of acidic dry and wet deposition on the soil.

Mancos milkvetch is restricted to a highly specific substrate. Indications are that some soil property may cause this restriction. A study is needed to define this plant-soil association. This study should include soil test for total nitrogen, pH, particle size, and cation-exchange capacity. Tests for the presence of trace elements such as selenium, rubidium, and manganese should also be included.

212. Study the water needs of the Mancos milkvetch.

The Mancos milkvetch has an affinity for depressions in the sandstone, suggesting that water is critical for their development. Studies .of the water requirements for this species should be undertaken.

213. Study the role of biotic factors in the Mancos milkvetch's ecology.

External biotic factors such as competition, predators and herbivores affect most species, and the effects of such factors on the Mancos milkvetch need to be studied.

2131. Herbivores.

Although a variety of large herbivores exist in the area, there is currently no evidence that they destroy plants or plant parts of the Mancos

milkvetch. However, it is likely that some insect species use this plant as a food source, but no studies have been performed.

2132. Pollinators.

Honey bees and butterflies have been observed visiting and possibly pollinating the tlancos milkvetch. To identify all pollinators and evaluate their significance to Mancos milkvetch, a field study is needed.

2133. Other organisms.

The occurrence of Mancos milkvetch on specific. substrates may be due to the presence in these substrates of root organisms (i.e., mycorrhizal - fungi, nodulating bacteria) that form critical symbiotic relationships with the milkvetch. These relationships may influence the distribution of the Mancos milkvetch to a greater degree than specific edaphic characteristics (as previously proposed). To determine the existence and/or importance of symbiotic organisms,. roots should be examined and organisms and relationships should be identified.

2134. Competition from dominant species.

Competition from the dominant plant species in the

area may be functioning as a restricting biotic factor. This needs to be tested, possibly through transplantation experiments with both seedlings and mature plants. Ecophysiological attributes that may provide a competitive advantage should also be studied (Goldberg 1982).

214. Study the geology of the Preferred habitat of the Mancos milkvetch.

The Mancos milkvetch is confined to a limited and distinct sandstone unit. The reason for the high degree of edaphic specificity of the Mancos milkvetch needs to be understood before the characteristics of its habitat can be defined. A geological field analysis of this formation should be conducted to ascertain its position and relationship with the surrounding Mesozoic rocks of the area:

22. Study the population biology of the Mancos milkvetch.

The life history of the Mancos milkvetch should be studied because it reflects the taxon's adaptation to its environment. The preference of this species for sandstone depressions indicates that there are characteristics of the microhabitat that are essential to its survival. These characteristics can modify plant productivity, fecundity and survival. Adaptation,to such an unusual microhabitat can confer a selective advantage to the Mancos milkvetch over other species that are not as specifically

adapted. Studies of milkvetch subpopulations can identify abiotic and biotic components that are most essential to plant survival.

221. Life history reuuirements.

Some factors to be studied are seed germination requirements, seedling establishment requirements, seedling survival and growth rate in varying microhabitats, the level and variation in anthesis, the success rate of pollination, the percentage of seed set and fruit developed, and the mode and method of seed dispersal.

222. Demographic variation.

Natural populations often fluctuate in numbers and density in normal cyclical variation. Whether such cycles exist for the Mancos milkvetch needs to be determined.

23. Develop reclamation techniques for disturbed population sites of Mancos milkvetch.

Current studies of disturbed Mancos milkvetch sites indicate that methods may be developed to successfully reintroduce this species into previously disturbed habitat through the creation of artificial microhabitats.

231. Gather data on soil erosion and auuradation on various slopes of the site.

Before microhabitat can be restored, the rate of erosion and

soil aggradation on Mancos milkvetch sites must be understood.

232. Experiment with reclamation techniuues on disturbed population sites.

Apply the results of 231 and create shallow catchment basins that will hold the soil in a similar method as the natural depression.

24. Inventory other suitable habitat for Astrauulus humillimus.

All potential habitat should be inventoried to ascertain if any additional populations of Mancos milkvetch exist.

25. Apply the results of studies undertaken in tasks 21, 22, 23, and 24 to revise the habitat management plans.

Throughout the course of data collection and monitoring, it may become apparent that aspects of the initial management plan are not the most effective way to recover the species. If this is the case, the management plan should be revised to reflect the newly obtained information.

3. Conduct laboratory studies on the Mancos milkvetch.

To gain a better understanding of the biology of this species, laboratory studies are required to determine certain aspects of its growth and development.

31. Seed bioloav.

A study of the seed biology of the Mancos milkvetch should be undertaken. This study should include germination requirements,vernalization, dormancy, and a search for anti-herbivore compounds in the seed.

32. Chemical analysis of tissue.

After several seasons of field study on the Mancos milkvetch, there is no evidence that the foliage is eaten by herbivores. A tissue analysis of the leaf material should be conducted to ascertain the presence of anti-herbivore compounds (e.g., alkaloids). This information will be useful in determining the role of herbivory as a threat to this species.

4. Develop public awareness, appreciation, and support for preservation of Mancos milkvetch.

Education of the public can be a vital part of the recovery of a species. The cooperation of the public can be essential for the ultimate success of ongoing recovery measures. Many public interest groups, such as native plant societies and The Nature Conservancy, can lend physical support to *recovery* efforts, and aid in the management of habitat for the species.

Literature Cited

Barneby, R.C. 1964. Atlas of North American Astragalus. Memoirs of the New York Botanical Garden. Vol. II: 1007.

Brandegee, T.S. 1876. The flora of southwestern Colorado. Bulletin of the U.S. Geological Survey. 2:235.

Colorado Department of Natural Resources. 1987.. Astraaalus humillimus Survey - 1987 Report. Denver, Colorado. 7 PP.

Deardorff, D. 1982. A preserve design for Astraaalus humillimus. Prepared for the New Mexico Nature **Conservancy,** Albuquerque, New Mexico. Manuscript.

Goldberg, D.E. 1982. The distribution of evergreen and deciduous trees relative to soil type: an example from the Sierra Madre, Mexico, and a general model. Madrono 27:79-89. .

Kuntz, 0. 1891. Trauacantha humillima. Revisio Generum. p. 945.

Martin, W.C. and C.R. Hutchins. 1980. A flora of New Mexico. J. Kramer Press, Germany. p. 2591.

Major, J.S. and S.A. Bamberg. 1963. Some cordilleran plant species new for the Sierra Nevada of California. Madrono 17:93-109.

Rydberg, T. 1905. Phaca humillima. Bulletin of the Torrey Botanical Club. 32:665.

Tuan, Y., C.E. Everard, J.G. Widdifon, and I. Bennett. 1973. The climate of New Mexico. The New Mexico State Planning Office, Santa Fe, New Mexico. p. 197.

U.S. Fish and Wildlife Service. 1985a. Determination that Astralauus humillimus is an endangered species. Federal Reuister 50:26568-26572.

_____. 1985b. Endangered and threatened wildlife and plants: review of plant taxa for listing as endangered or threatened species. Federal Reuister 50:39526-39584.

PART III

IMPLEMENTATION SCHEDULE

The Implementation Schedule that follows outlines actions and costs for the Hancos milkvetch 'recovery program. It is a guide for meeting the objectives elaborated in Part II of this plan. This schedule indicates the general category for implementation, recovery plan tasks, corresponding outline numbers, task priorities, duration of tasks ("ongoing" denotes a task that once begun should continue on an annual basis), the responsible agencies, and lastly, estimated costs for FWS tasks. These actions, when accomplished, should bring about the recovery of the Mancos milkvetch and protect its habitat. It should be noted that monetary needs for agencies other than FWS are not identified and, therefore, Part III does not reflect the total financial requirements of the recovery of this plant.

General Categories for Implementation Schedule

Information Gathering - I or R (research)

1. Population status
2. Habitat status
3. Habitat requirements
4. Management techniques
5. Taxonomic studies
6. Demographic studies
7. Propagation
8. Migration
9. Predation
10. Competition
11. Disease
12. Environmental contaminant
13. Reintroduction
14. Other information

Acquisition - A

1. Lease
2. Easement
3. Management agreement
4. Exchange
5. Withdrawal
6. Fee title
7. Other

Other - 0

1. Information and education
2. Law enforcement
3. Regulations
4. Administration

Management - M

1. Propagation
2. Reintroduction
3. Habitat maintenance and manipulation
4. Predator and competitor control
5. Depredation control
6. Disease control
7. Other management

Recovery Action Priorities

1 = an action that must be taken to prevent extinction or to prevent the species from declining irreversibly in the foreseeable future.

2 = an action that must be taken to prevent a significant decline in species population/habitat quality, or some other significant negative impact short of extinction.

3 = all other actions necessary to provide for full recovery of the species.

Abbreviations Used

FWS - USDI Fish and Wildlife Service
SE - Ecological Services Field Office
LE - Law Enforcement
BLM - USDI Bureau of Land Management
BIA - USDI Bureau of Indian Affairs
OSM - USDI Office of Surface Mining
NM - State of New Mexico
co - State of Colorado
NN - Navajo Nation
UMU - Ute Mountain Ute Indian Tribe

PART III - IMPLEMENTATION SCHEDULE

General Category	Plan Task	Task #	Priority #	Task Duration	Responsible Agency FWS Legion	FWS Program	Other	Fiscal Year Costs (EST)* FY 1	FY 2	FY 3	COMMENTS
02	Enforce existing Laws	11	1	Ongoing	2	LE SE	BLM BIA NM CO	5,000	5,000	5,000	
114	Document and assess the mineral and energy potential	12	2	1 year			BIA BLM OSM				
114	Contact landowners	13	1	Ongoing	2	SE		10,000	10,000	10,000	
M7	Develop C.A.'s between BIA, BLM, UN, UMU, NM, and FWS	14	2	1 year	2	SE	BLM BIA NN UMU NM	2,000			
M3	Develop and implement HMP's	15 16	1	Ongoing	2	SE	NN UMU NM	5,000			
A3	Monitor populations and habitat	17	2	Ongoing	2	SE	BLM BIA NN UMU NM CO	1,500	1,500	1,500	
R3	Study ecological requirements	21	2	5 years	2	SE	BIA BLM NM CO	20,000	20,000	20,000	

*Costs refer to USFWS expenditures only.

PART III - IMPLEMENTATION SCHEDULE
(continued)

General Category	Plan Task	Task #	Priority #	Task Duration	Responsible Agency FWS Region	FWS Program	Other	Fiscal Year Costs (EST)* FY 1	FY 2	FY 3	COMMENTS
1, R6	Study population biology	22	2	5 years	2	SE		20,000	5,000	5,000	
M3	Develop reclamation techniques	23	2	5 years	2	SE		7,000	7,000	7,000	
11	Inventory potential habitat	24	2	2 years	2	SE	BLM BIA NN UMU NM.	15,000	10,000	LO, 000	
14	Apply results of ecology and population biology studies	25	2	Ongoing	2	SE		2,000	2,000	2,000	
13	Study seed biology and plant tissue	31,32	2	2 years	2	SE		10,000	10,000		
01	Develop public awareness and support	4	3	Ongoing	2	SE		5,000	1,000	1,000	

*costs refer to USFWS expenditures only.

APPENDIX

List of Reviewers

A technical/agency review draft of the Mancos Uilkvetch Recovery Plan was sent to the following individuals and agencies on December 9, 1986.

Mr. Jim Baca, State Land Office, Santa Fe, NM

Mr. Peterson Zah, Chairman, The Navajo Nation Council, Window Rock, AZ

Mr. Wilson Barber, Area Director, Bureau of Indian Affairs, Navajo Area Office, Gallup, NM

Hr. Bill Allen, Bureau of Indian Affairs, Albuquerque Area Office, Albuquerque, NM

Mr. Galen Buterbaugh, Regional Director, U.S. Fish & Wildlife Service, Region 6, Denver, CO

Field Supervisor, Ecological Services Field Office, U.S. Fish & Wildlife Service, Region 2, Albuquerque, NM

Assistant Regional Director - Law Enforcement, U.S. Fish & Wildlife Service, Region 2, Albuquerque, NM

Director, U.S. Fish & Wildlife Service, Washington, D.C.

State Director, Bureau of Land Management, Santa Fe, NH

Mr. Paul Knight, Department of Natural Resources, Santa Fe, NM

Ms. Ann Cully, Department of Energy, Minerals and Natural Resources, Santa Fe, NM

Mr. Reggie Fletcher, U.S. Forest Service, Albuquerque, NM

Dr. Richard Spellenberg, New Mexico State University, Las Cruces, NM

Ms. Donna House, Navajo Natural Heritage Program, Window Rock, AZ

Mr. Gerard Hoddenbach, National Park Service, Santa Fe, NM

Mr. Brian Bills, Bureau of Land Wanagement, Santa Fe, NM

Hr. John Egbert, The Nature Conservancy, Albuquerque, NE

Dr. Frank R. Thibodeau, The Center for Plant Conservation, Jamaica Plain, ES

Mr.' Scott Peterson, The Nature Conservancy, Denver, CO'

Hr. Steve Okane, Colorado Natural Areas Program, Denver, CO

Dr. Rupert Barneby, The New York Botanical Garden, Bronx, NY

Comments Received

Comment letters are reproduced in this section followed by the Service's response to each comment. Some reviewers submitted comments marked directly on the draft plan or submitted comments by phone. These comments have not been reproduced.

United States Department of Agriculture
Forest Service
Southwestern Region
517 Gold Avenue SW.
Albuquerque, NM 87102

Reply To: 2670

Date: January 27, 1987

Mr. Conrad Fjetland
Assistant Regional Director
USDI-Fish and Wildlife Service
P.O. Box 1306
Albuquerque, NM 87103

Dear Mr. Fjetland:

As requested in your letter of December 9, 1986, and Mr. Jack Woody's letter of December 18, 1986, the following are my comments on the Atriplex pleiantha and Astragalus humillimus documents as requested. Since these species do not occur on lands within the National Forest System, my comments were prepared as a New Mexico Plant Recovery Team member.

The Impacts and Threats section of the Draft Astragalus humillimus Recovery Plan, page 13, includes comments on scientific collection. The draft states "even though a relatively small number of plants are collected per year, taking must be considered a threat." Collection on Federal lands is prohibited under the Act unless done by permit from the Fish and Wildlife Service. The above quote gives the impression that scientific collection is not regulated. However, scientific collection is not adversely affecting the continued survival of any species in the Southwest at the present time. Differentiation should also be made between collection of whole plants and collection of portions of plants, which can usually be done with little to no damage. A-1

The Objectives section on page 17 includes actions necessary for delisting. It is probably too early to adequately address delisting needs. Current Recovery Plan objectives should concentrate on a goal of downlisting to threatened. A-2

Item 24 on page 22 indicates a need for inventory of "other suitable habitat for Astragalus humillimus." If apparently suitable but presently unoccupied habitat is found, attempts should be made to establish a well monitored experimental population. A-3

[Information on Atriplex deleted]

Sincerely,

REGGIE FLETCHER
Regional Botanist

The New York Botanical Garden

Bronx. New York 10458 (212) 220-8700

Region 2: SE

Assistant Regional Director,
U.S. Fish & Wildlife Service,
Albuquerque, NM

10.xii.86

Dear Sir: I thank you for sending the copy of your draft plan for recovery of **Astragalus humillimus.**
B-l I can confirm the scientific accuracy of your data and endorse without qualification your efforts to preserve this **marvellous** little plant.

With best wishes,
Yours sincerely,

Rupert C. Barneby

Rupert C. Barneby,
Curator

RD
DRD
ABA
AFF
ARW
AWE
ALE
APA
AHR
Cole
File SE
Action
CL

End. Sp. R-2
JOHNSON
LANGOWSKI
Burton
Davis
Lovato
Lucas
SANCHEZ
FILE

FWS REG 2
RECEIVED
DEC 1 5 '86
SE

RECD
FWS-Region 2
DEC 12 1986
AFF

Rocky Mountain
Natural Heritage Program
1370 Pennsylvania Street
Denver, Colorado 80203

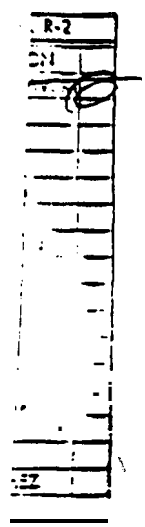
MEM

Peggy Olwell:

Attached are my comments on A. humillimus. Good to see the NRSS & NNHP cooperation.

Scott

C-1



I would also recomend that a recovery team be named to include the following:

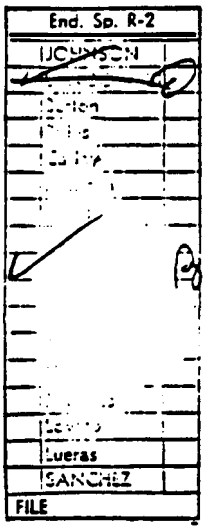
- USFWS, Region 2
- NM Natural Resources Survey Section
- Navajo Natural Heritage Program
- New Mexico Native Plant Society
- The Nature Conservancy
- Bureau of Land Management
- NM State Lands
- Ute Mountain Environmental Officer
- Colorado Natural Areas Program

Comments
pages
14
20
23
28
18

FWS REG 2
RECEIVED
DEC 24 '86
SE

STATE OF COLORADO

COLORADO NATURAL AREAS PROGRAM
Department of Natural Resources
1313 Sherman Street. Room 718
Denver. Colorado 60203
Phone (303)866-3311



ABA
AFF
ARW
A W E -
ALE
APA -
AHR
Cole
File
Action SE
CL 2-18 4

Rec'
FWS-Re
FEB 9

February 5, 1987

Mr. Michael Spear
Regional Director, Region 6
U.S. Fish and Wildlife Service
P.D. Box 1306
Albuquerque, NM 87103

Dear Mr. Spear:

I offer the following comments on the Technical/Agency Draft of the Moncos Milkvetch (Astragalus humillimus) Recovery Plan.

- pg. 1, line 2. Change 'Heritage' to 'Natural Areas.
- pg. 5. The distribution map should include the Colorado population and should be more specific in New Mexico. The map would be better if it included northern New Mexico, southern Colorado and a glimpse of Arizona and Utah.
- pg. 7, line 1-9. Using known population densities and estimated acres of habitat is an unsure way of arriving at number of estimated individuals in another area.
- pg. 7, second paragraph. The exfoliating nature of 'the sandstone habitat should be mentioned.
- pg. 25, task 7411. The buffer zone uphill from a population should be greater, perhaps 150 meters, to avoid Impacts from oil spills and possible erosion caused from oil well construction. Development between nearby populations should be avoided so that habitat is not further fragmented and so that the potential for gene flow between populations remains.

Thank you for the opportunity to comment on this Recovery Plan. It is well written and comprehensive.

Cordially,

Steve L. O'Kane, Jr.
Botanist/Inventory Coordinator
Colorado Natural Areas Program

SLO:sc
3400-2

FWS REG 2
RECEIVED
FEB 1 1 '87
SE

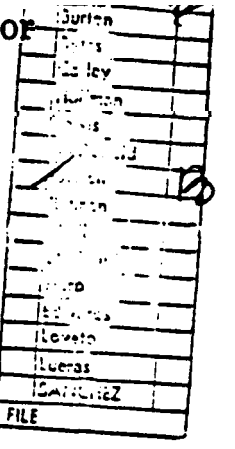
United States Department of the Interior
FISH AND WILDLIFE SERVICE

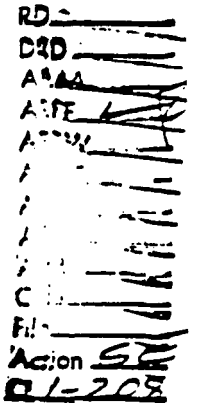
MAILING ADDRESS:
Post Office Box 25486
Denver Federal Center
Denver, Colorado 80225

STREET LOCATION:
134 Union Blvd.
Lakewood, Colorado 80228

IN REPLY REFER TO:
FWE/SE/Mancos Milkvetch-
Recovery Plan
Mail Stop 60153

JAN 16 1987





MEMORANDUM

To: Regional Director, Region 2, Albuquerque, New Mexico
Attention: Peggy Olwell

From: Acting Regional Director, Region 6, Denver, Colorado

Subject: Recovery Plan for the Mancos Milkvetch (Astragalus humillimus)

This responds to your December 2, 1986, memorandum requesting comments on the technical/agency draft Mancos Milkvetch (Astragalus humillimus) Recovery Plan. We have completed our review of the subject plan. The following represents both Field and Regional Office comments on the draft plan.

p. 4, lines 5-7. Past and historic ranges: Astragalus humillimus is a member of a highly specialized group of species, Section Humillimi, that are widely disjunct from each other (Barneby 1964). This fragmented occurrence and the edaphic restriction of some of the species is indicative of a relictual distribution pattern (Gankin and Major 1964). Thus, Astragalus humillimus is a remnant of a once more widespread group, and its current rarity may not be reflective of the extent of its past distribution. E-1

p. 5. The distribution map for Astragalus humillimus should also include its range in Colorado. E-2

p. 7, lines 3-7. Population estimates: Extrapolation should not be used to arrive at a total species number since it assumes that population densities are evenly distributed over the habitat. Initial population counts are usually made where the population was first discovered which is likely to be where the population is most dense. This can lead to artificially high estimates of total species number. For example, it is stated on page 11, lines 1-9, that population densities at the seven localities vary by nearly 1,000 percent. E-3

p. 7, lines 14-21. Soil Properties: As noted, the substrate that Astragalus humillimus grows on is characterized by a peculiar exfoliation. This physical property may be a more important factor in influencing the distribution of Astragaius humillimus than soil chemical properties. E-4

p. 9, lines I-3. Associated species: The occurrence of several other peripheral species together with Astragalus humillmus on this peculiar edaphic substrate of exfoliating sandstone suggests that these species may be avoiding competition from the dominant vegetation through a tolerance of, rather than a requirement for, peculiar soil properties (Major and Bamberg 1963). E-5

p. 25, Task 1411: One factor that may be contributing to the rarity of Astragalus humillimus is its natural fragmentation into small-sized populations, resulting in lowered genetic variability. Therefore, we seriously question the placement of any oil wells within existing population sites as well as the buffer zone concept. This would only result in further population fragmentation, and should not be permitted. E-6

p. 30, Task 213: Add Task 2134 Competition: As indicated in the comments on page nine above, competition from the dominant plant species in the area may be functioning as a restricting biotic factor. This needs to be tested, possibly through transplantation experiments with both seedlings and mature plants. Ecophysiological attributes that may provide a competitive advantage should also be studied (Goldberg 1982). E-7

p. 33, Task 23: Because the habitat of Astragalus humillimus has already been impacted, emphasis should be given to developing reclamation techniques for its reintroduction into historical habitat. In the Implementation Schedule, page 41, Task 23 should be changed to Priority 2. E-8

Additional comments have been indicated in the enclosed copy of the plan.

This is a well-written recovery plan, particularly the reclamation methodology. We look forward to working with you on the recovery of the Mancos milkvetch.

Enclosure

JOHN L SPINKS, JR.

Response to Comments

A-1 The Service understands that it is illegal to collect **'this plant** on Federal lands: however, botanists from **several** universities and community colleges collected this species when it was rediscovered prior to the listing under the Endangered Species Act. Al though collection is not a major threat, the threat still exists because of the remoteness of the sites where Astragalus humillimus occurs.

A-2 The delisting criteria are preliminary and may be revised on the basis of new information. , In addition, these criteria will be evaluated for adequacy prior to delisting.

A-3 Comment incorporated under Task 214.

B-l Comments incorporated.

C-l Comments incorporated.

D-l Change made.

D-2 Comment incorporated.

D-3 Suggestion has been incorporated into plan.

D-4 Comment noted.

D-5 Comment incorporated.

E-l The Service agrees that the fragmented occurrence and edaphic restriction of the group of species in Section Humillimi is indicative of a relictual distribution pattern. The Service believes that **an** ancestral species was probably more widely dispersed but not the species Astragalus humillimus.

E-2 Hap changed to include Colorado populations.

E-3 Comment incorporated.

E-4 This information has been added to the **plan.**

E-5 Comment incorporated.

E-6 Suggestion has been followed.

E-7 This task has been added to the plan.

E-8 The change in priority has been made.